Document Title	Assignment 03
Course	CS 200 Introduction to Programming
Academic Year	2016-2017
Semester	Fall
Due Date	November 5, 2016 11:55 pm
Marks	100

The assignment is due on **November 5, 2016 at 11:55 pm**. There is no late submission policy for this assignment. This assignment will require reasonable amount of time so try to start the assignment as early as you can.

Please keep in mind the following guidelines:

- Do not share your program code with anyone.
- Do not copy code from the internet.
- If you receive any assistance, mention the part of code in which you received assistance.
- You must be able to explain any part of your submitted code.
- All submissions are subject to automated plagiarism detection.

What to submit:

You have to submit .cpp files containing source code. Zip all .cpp files into one file named as <your 8 digit roll number>.zip and submit the zip file.

Task 1   Free Cell Game   (95 + 5 marks)

[95 marks for code; 5 marks for proper variable and function names and proper indentation]

You have to write code for Free Cell game in C++. You are required to use pointers in this task. You can't use vectors in this task.

You may need to play actual Free Cell game also to get better understanding and familiarity of game rules.

Free Cell is a single player one deck card game. In Free Cell game, there are eight tableau piles/columns of cards, four Free Cells on the upper left corner and four Home slots on upper right corner.

When a new starts, each of first four tableau piles has seven cards and remaining four tableau piles have six cards each. Cards should be in random order in tableau piles. There are four free cell slots and four home slots which are empty at the start of game. Each of free cell slots can contain one card at any time. In each Home slot player has to pile up thirteen cards of each suit in ascending order starting from Ace to King. When player piles up all the cards to home positions i-e thirteen cards of each suit to each home slot, player wins the game.

A card can be represented by two values: first value will represent rank of card and second value will represent the suit of card. You can use only first letter of suit name to represent suit e.g '*A d*' represents Ace of 'diamond' suit or whatever the way you like.

You can move only top most/exposed card(s). You can move card(s) from

>   i)   tableau pile to another tableau pile
>   ii)   tableau pile to free cell
>   iii)   free cell to tableau pile
>   iv)   tableau pile to home slot
>   v)   free cell to home slot

- **Tableau Pile to Tableau Pile Move:**
  You can move a card from one tableau pile to another tableau pile if card of source tableau pile and card of destination tableau pile are of alternating color and source tableau card is immediate descendent in rank of destination tableau card [except for the Ace card, Ace card should be moved to Home slot]. You can also move multiple cards in one move if the source cards follow the above mentioned rule i-e after moving multiple cards from source tableau pile, resulting tableau will form a descending sequence of cards with alternating colors.
- **Tableau Pile to Free Cell Move:**
  You can move any top most/exposed card from any tableau pile to any available Free Cell slot except for Ace card. Ace card should be moved to Home slot.
- **Free Cell to Tableau Pile Move:**
  A card from free cell slot can be moved to tableau card if it follows the condition mentioned in

tableau to tableau move i-e card of source Free Cell and card of destination tableau pile are of alternating color and source Free Cell card is immediate descendent in rank of destination tableau card.

- **Tableau pile to Home Move:**
  The first card that will be moved to Home slot will be Ace card. After Ace card, cards will be piled up in Home slot in successive ascending order till King. Each home slot will contain pile of cards of a particular suit only. When all cards will be moved to home slots, player wins the game.

- **Free Cell to Home Move:**
  A card from Free Cell can be moved to home slot if the suit of free cell card is same as that of cards(if present) in home slot and free cell card should be in successive ascending order. If any Home slot is empty, the first card that will be moved to Home slot should be Ace card.

After each successful move, you have to show updated game state. In case of invalid move, show error message.

One problem with above implementation is that a user can't save his unfinished game and can't resume his unfinished game. So you also need to add the functionality of saving an ongoing game state to a file and a player can resume his saved game if he wishes to do so.

When your program runs, it should allow user to resume previously saved game or start a new game. Each time when a new game starts, cards should be placed in random order in eight tableau piles. You can use *random function* to achieve this functionality. Sample screen shots of Free Cell game are attached. You can design a better interface for sure.

```
                    *** THIS IS FREE CELL GAME ***
    Press 1 to start a new game
    Press 2 to resume a saved game
1
                 *** THIS IS FREE CELL GAME ***


    ____  ____  ____  ____  ____        ____  ____  ____  ____  ____
   |    ||    ||    ||    ||    |      |    ||    ||    ||    ||    |
   |    ||    ||    ||    ||    |      |    ||    ||    ||    ||    |
   |    ||    ||    ||    ||    |      |    ||    ||    ||    ||    |
    ____  ____  ____  ____  ____        ____  ____  ____  ____  ____


   | 2s |   | 6h |   | 9d |   | 5d |    | 3d |   | 3c |   | 9c |   | 7h |

   | Kh |   | 7d |   | 10s|   | Jh |    | Kc |   | 6c |   | 10h|   | 3s |

   | 5s |   | Ks |   | 7c |   | 5h |    | Ac |   | Jc |   | Qs |   | 4c |

   | 8s |   | 6d |   | 2h |   | 4h |    | 9s |   | 6s |   | 2d |   | Qh |

   | 2c |   | Jd |   | 7s |   | Qd |    | As |   | 10c|   | 8c |   | Js |

   | Kd |   | Qc |   | 8h |   | Ad |    | 8d |   | 4d |   | 3h |   | Ah |

   | 9h |   | 5c |   | 4s |   | 10d|


    Press 1 for column to column move
    Press 2 for column to free-cell move
    Press 3 for free-cell to column move
    Press 4 for column to home move
    Press 5 for free cell to home move
    Press 6 to save your unfinished game
1
  enter the column number as source
7
  enter the column number as destination
3
  enter the number of cards to be moved
1
                 *** THIS IS FREE CELL GAME ***


    ____  ____  ____  ____  ____        ____  ____  ____  ____  ____
   |    ||    ||    ||    ||    |      |    ||    ||    ||    ||    |
   |    ||    ||    ||    ||    |      |    ||    ||    ||    ||    |
   |    ||    ||    ||    ||    |      |    ||    ||    ||    ||    |
    ____  ____  ____  ____  ____        ____  ____  ____  ____  ____


   | 2s |   | 6h |   | 9d |   | 5d |    | 3d |   | 3c |   | 9c |   | 7h |

   | Kh |   | 7d |   | 10s|   | Jh |    | Kc |   | 6c |   | 10h|   | 3s |

   | 5s |   | Ks |   | 7c |   | 5h |    | Ac |   | Jc |   | Qs |   | 4c |

   | 8s |   | 6d |   | 2h |   | 4h |    | 9s |   | 6s |   | 2d |   | Qh |

   | 2c |   | Jd |   | 7s |   | Qd |    | As |   | 10c|   | 8c |   | Js |

   | Kd |   | Qc |   | 8h |   | Ad |    | 8d |   | 4d |           | Ah |

   | 9h |   | 5c |   | 4s |   | 10d|

                     | 3h |
```

```
 Press 1 for column to column move
 Press 2 for column to free-cell move
 Press 3 for free-cell to column move
 Press 4 for column to home move
 Press 5 for free cell to home move
 Press 6 to save your unfinished game
4
 ENTER COLUMN NUMBER ...:
8
 ENTER HOME NUMBER ....:
1
                    *** THIS IS FREE CELL GAME ***
```

```
 _____   _____   _____   _____              _____   _____   _____   _____   _____
|     | |     | |     | |     | |     | | Ah | |     | |     | |     | |     |
|     | |     | |     | |     | |     | |     | |     | |     | |     | |     |
|     | |     | |     | |     | |     | |     | |     | |     | |     | |     |
 _____   _____   _____   _____              _____   _____   _____   _____   _____


  _____   _____   _____   _____              _____   _____   _____   _____
 | 2s |  | 6h |  | 9d |  | 5d |            | 3d |  | 3c |  | 9c |  | 7h |
  _____   _____   _____   _____              _____   _____   _____   _____
 | Kh |  | 7d |  | 10s|  | Jh |            | Kc |  | 6c |  | 10h|  | 3s |
  _____   _____   _____   _____              _____   _____   _____   _____
 | 5s |  | Ks |  | 7c |  | 5h |            | Ac |  | Jc |  | Qs |  | 4c |
  _____   _____   _____   _____              _____   _____   _____   _____
 | 8s |  | 6d |  | 2h |  | 4h |            | 9s |  | 6s |  | 2d |  | Qh |
  _____   _____   _____   _____              _____   _____   _____   _____
 | 2c |  | Jd |  | 7s |  | Qd |            | As |  | 10c|  | 8c |  | Js |
  _____   _____   _____   _____              _____   _____
 | Kd |  | Qc |  | 8h |  | Ad |            | 8d |  | 4d |
  _____   _____   _____   _____
 | 9h |  | 5c |  | 4s |  | 10d|
                  _____
                 | 3h |
```

```
 Press 1 for column to column move
 Press 2 for column to free-cell move
 Press 3 for free-cell to column move
 Press 4 for column to home move
 Press 5 for free cell to home move
 Press 6 to save your unfinished game
2
 Enter column number as source
7
 Enter number of free-cell
3
                *** THIS IS FREE CELL GAME ***


 _____  _____  _____  _____            _____  _____  _____  _____  _____
|    |  |    |  |    |  | 8c|  |    |      | Ah |  |    |  |    |  |    |  |    |  |    |
|    |  |    |  |    |  |    |  |    |      |    |  |    |  |    |  |    |  |    |  |    |
|    |  |    |  |    |  |    |  |    |      |    |  |    |  |    |  |    |  |    |  |    |
 _____  _____  _____  _____            _____  _____  _____  _____


 _____  _____  _____  _____            _____  _____  _____  _____
| 2s |  | 6h |  | 9d |  | 5d |            | 3d |  | 3c |  | 9c |  | 7h |
 _____  _____  _____  _____            _____  _____  _____  _____
| Kh |  | 7d |  | 10s|  | Jh |            | Kc |  | 6c |  | 10h|  | 3s |
 _____  _____  _____  _____            _____  _____  _____  _____
| 5s |  | Ks |  | 7c |  | 5h |            | Ac |  | Jc |  | Qs |  | 4c |
 _____  _____  _____  _____            _____  _____  _____  _____
| 8s |  | 6d |  | 2h |  | 4h |            | 9s |  | 6s |  | 2d |  | Qh |
 _____  _____  _____  _____            _____  _____  _____  _____
| 2c |  | Jd |  | 7s |  | Qd |            | As |  | 10c|            | Js |
 _____  _____  _____  _____            _____  _____
| Kd |  | Qc |  | 8h |  | Ad |            | 8d |  | 4d |
 _____  _____  _____  _____            _____  _____
| 9h |  | 5c |  | 4s |  | 10d|
 _____  _____  _____  _____
                 | 3h |
                  _____


 Press 1 for column to column move
 Press 2 for column to free-cell move
 Press 3 for free-cell to column move
 Press 4 for column to home move
 Press 5 for free cell to home move
 Press 6 to save your unfinished game
5
 Enter Free Cell Number
3
 Enter Home Number
1
 *** INVALID MOVE ***
```

```
 Press 1 for column to column move
 Press 2 for column to free-cell move
 Press 3 for free-cell to column move
 Press 4 for column to home move
 Press 5 for free cell to home move
 Press 6 to save your unfinished game
1
 enter the column number as source
4
 enter the column number as destination
8
 enter the number of cards to be moved
1
                *** THIS IS FREE CELL GAME ***


 ____  ____  ____  ____  ____  ____         ____  ____  ____  ____  ____  ____
|    ||    ||    || 8c||    ||    |        | Ah ||    ||    ||    ||    ||    |
|    ||    ||    ||    ||    ||    |        |    ||    ||    ||    ||    ||    |
|    ||    ||    ||    ||    ||    |        |    ||    ||    ||    ||    ||    |
 ____  ____  ____  ____                     ____  ____  ____  ____  ____


 ____        ____        ____        ____         ____        ____        ____        ____
| 2s |      | 6h |      | 9d |      | 5d |        | 3d |      | 3c |      | 9c |      | 7h |
 ____        ____        ____        ____         ____        ____        ____        ____
| Kh |      | 7d |      | 10s|      | Jh |        | Kc |      | 6c |      | 10h|      | 3s |
 ____        ____        ____        ____         ____        ____        ____        ____
| 5s |      | Ks |      | 7c |      | 5h |        | Ac |      | Jc |      | Qs |      | 4c |
 ____        ____        ____        ____         ____        ____        ____        ____
| 8s |      | 6d |      | 2h |      | 4h |        | 9s |      | 6s |      | 2d |      | Qh |
 ____        ____        ____        ____         ____        ____                    ____
| 2c |      | Jd |      | 7s |      | Qd |        | As |      | 10c|                  | Js |
 ____        ____        ____        ____         ____        ____                    ____
| Kd |      | Qc |      | 8h |      | Ad |        | 8d |      | 4d |                  | 10d|
 ____        ____        ____
| 9h |      | 5c |      | 4s |
                         ____
                        | 3h |



 Press 1 for column to column move
 Press 2 for column to free-cell move
 Press 3 for free-cell to column move
 Press 4 for column to home move
 Press 5 for free cell to home move
 Press 6 to save your unfinished game
6
 Your current game state has been saved..!!
 Press 1 for column to column move
 Press 2 for column to free-cell move
 Press 3 for free-cell to column move
 Press 4 for column to home move
 Press 5 for free cell to home move
 Press 6 to save your unfinished game
```